

ASCI Software Requirements



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<http://www.llnl.gov/asci>

3-teraOPS ASCI platforms



ASCI Red

- SNL (Intel prime contractor)
- 3.15 teraOPS peak
- 2 processors per scalable unit
- UNIX operating system
- 9360 333 MHz processors
- 1.2 terabyte memory
- 12.5 terabyte storage



ASCI Blue-Pacific

- LLNL (IBM prime contractor)
- 3.89 teraOPS peak
- 4 processors per scalable unit
- AIX operating system
- 5856 332 MHz processors
- 2.6 terabyte memory
- 52.5 terabyte storage

ASCI Blue-Mountain

- LANL (SGI prime contractor)
- 3.072 teraOPS peak
- 128 processors per scalable unit
- IRIX operating system
- 6144 250 MHz processors
- 1.5 terabyte memory
- 76 terabyte storage





More powerful platforms are required

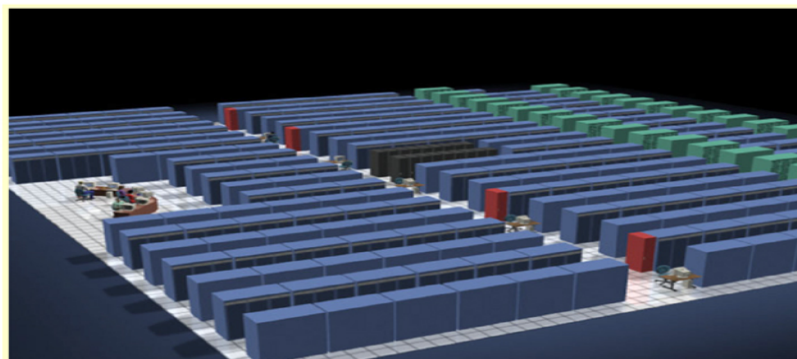


ASCI White

- LLNL (IBM prime contractor)
- 12.3 teraOPS peak
- 16 processors per scalable unit
- AIX operating system
- 8192 310 MHz processors
- 6 terabyte memory
- 160 terabyte storage

ASCI Q

- LANL (Compaq prime contractor)
- 30 teraOPS peak



Upcoming Systems:

- SNL “Red Storm” System - 20 TeraOps
- LLNL “Purple” System - 60 TeraOps

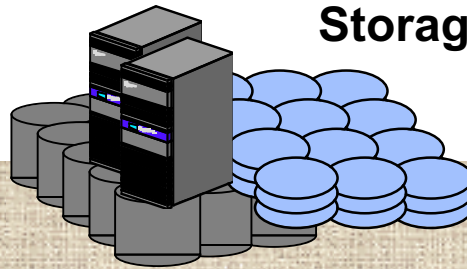
ASCI Office of Simulation & Computer Science Provides the Necessary Infrastructure to Run ASCI Platforms



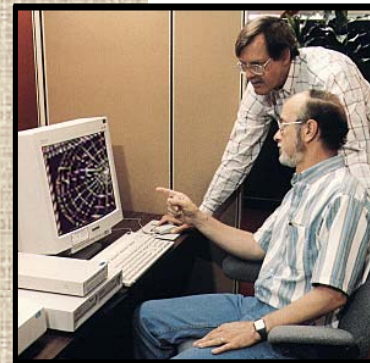
Platforms



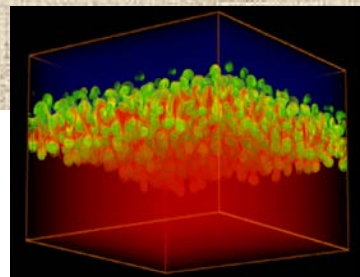
Storage & Servers



PSE
PathForward
DisCom
VIEWS



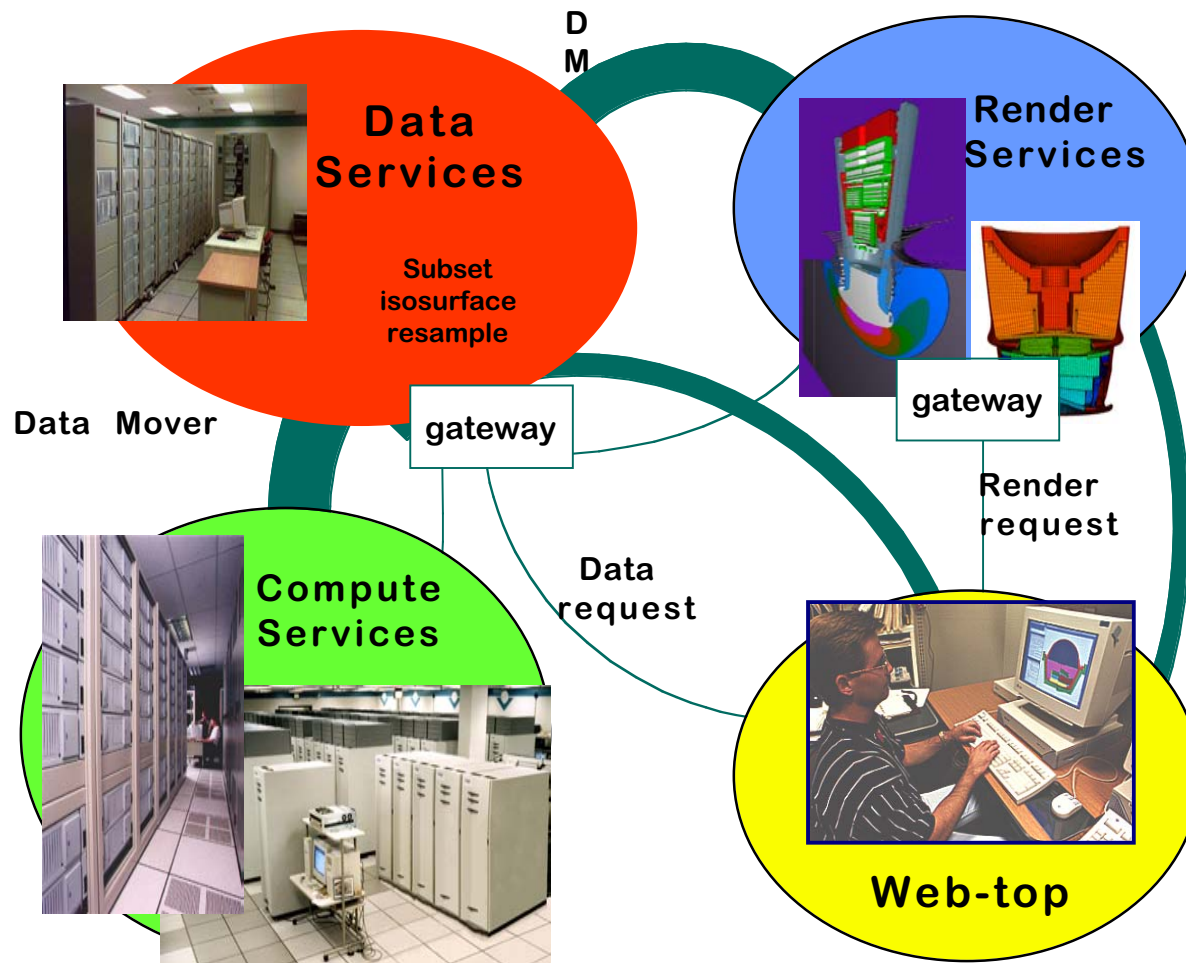
Scientists



Visualization

*Provide to the
designers,
engineers and
scientists
world-class
computing &
visualization
infrastructure
required for
SSP
simulations*

Visual Interactive Environment for Weapons Simulation (VIEWS) High-end Services From/To the Desktop



EXAMPLE:

Sandia Labs' current emphasis on the following system components:

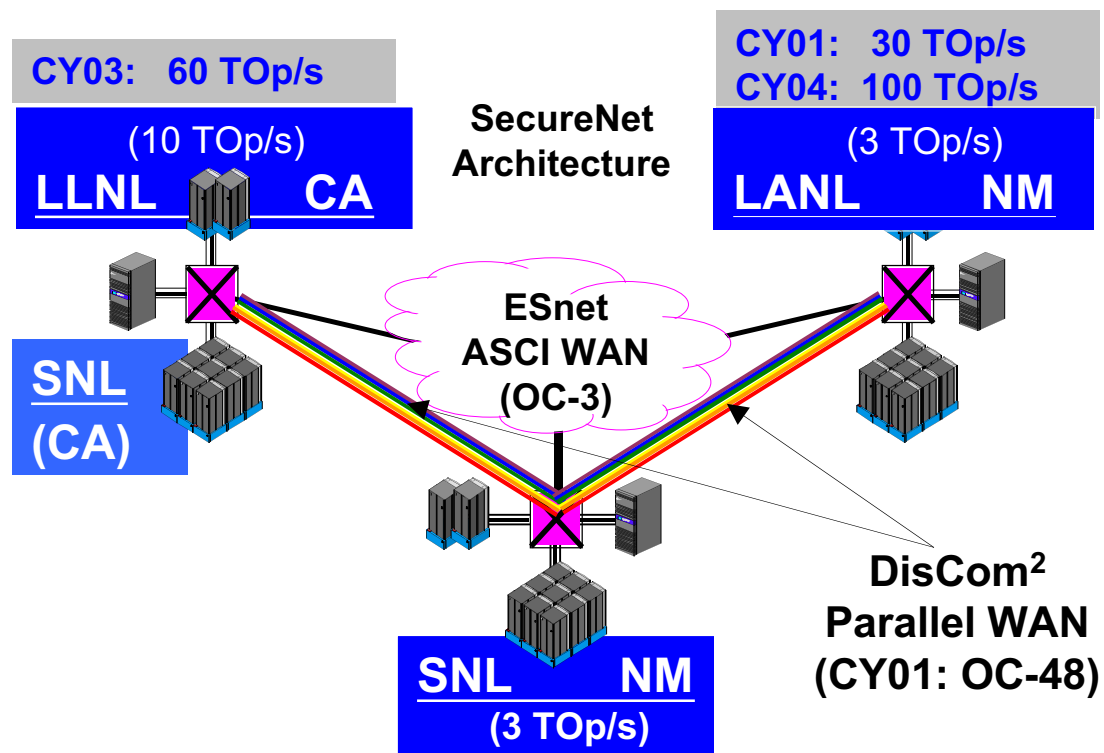
- Data Services
- Scalable Rendering
- Deployment of needed infrastructure and facilities

VIEWS Functional Architecture



Data Sources: Simulations, Archives, Experiments					Users Services: Navigation Rendering Control Advanced User Interface Collaborative Control Display Control
Data Services:	Permutation M ⇒ N	Filtering	1D/2D Subsetting	Data Algebra x,y,z ⇒ mag/Φ	
	Format/Representation Conversion	Data Reduction	Data Serving		
Information Services:	Feature Detection and Extraction		Data Fusion & Comparison		
	Visual Representations Generation (eg. isosurfaces)		Volume Visualization Preparation (eg. opacity assignment, resampling ...)		
Visualization Services:	Surface rendering	Volume rendering	Runtime services		
	Multi-Visualization Technique Combine	Time Sequence Generation			
Display Modalities:	Desktop Display	Theater Display	Powerwalls	Immersive Stereoscopic	

Distance Computing (DISCOM) Provides the Bridge Between Designers/ Analysts and High-End Distributed Computational Resources



The ASCI WAN provides much improved access to the complex's classified weapon information, wherever it is located.

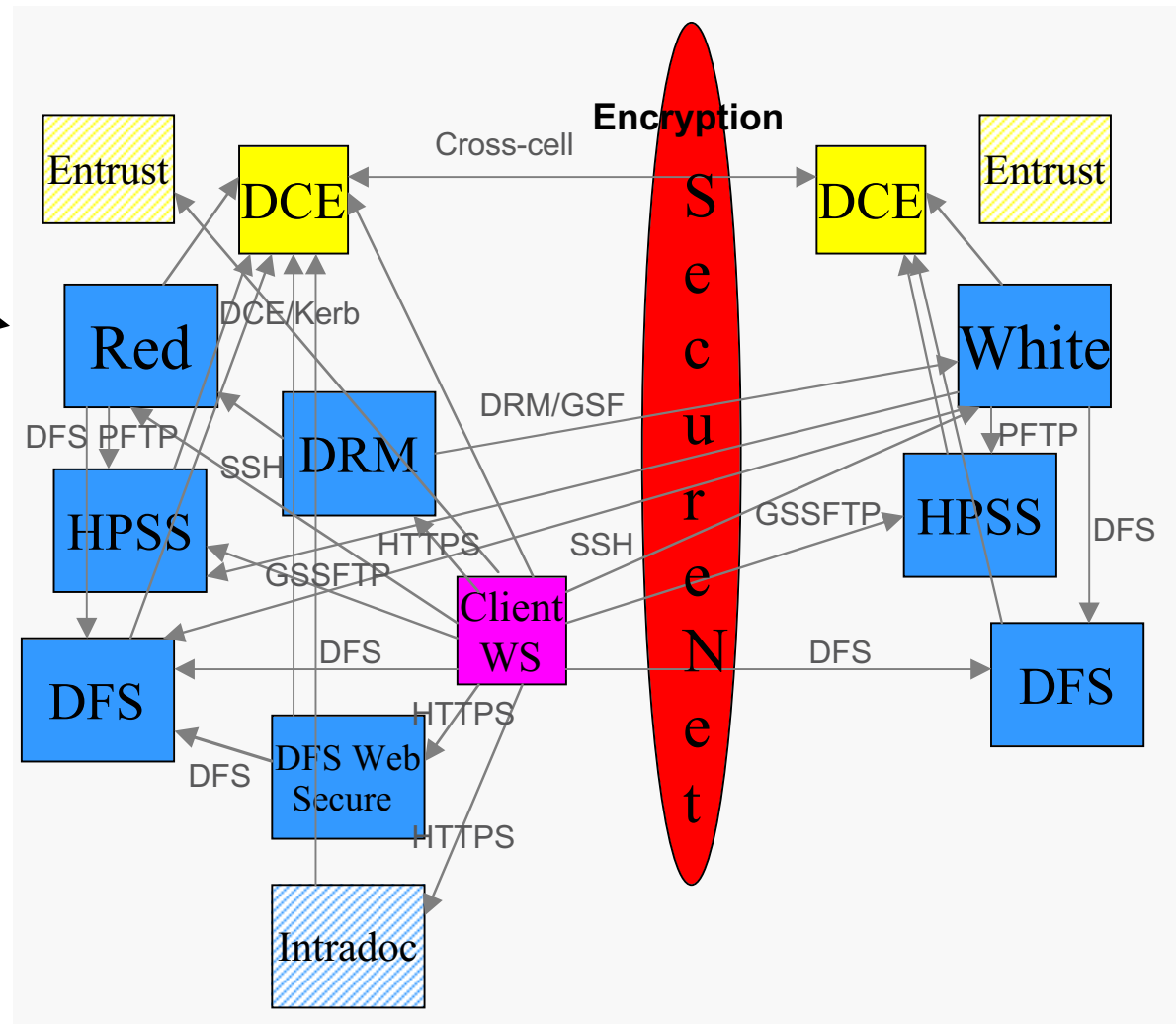
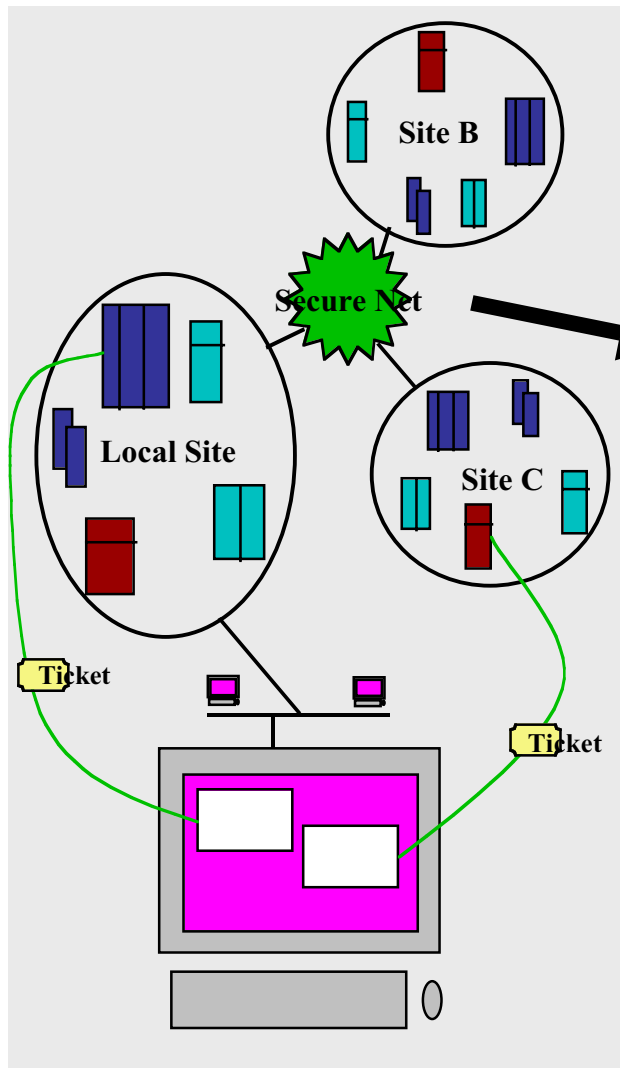
Desktops to TeraOps!

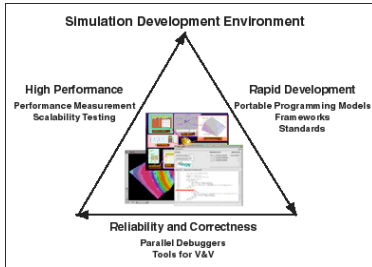
Providing designers, analysts, and engineers, the portal to high-performance computing resources

Strategies:

- Develop, deliver, deploy an effective & efficient production distance computing solution
- Integrate computing capabilities distributed throughout complex
- Grid computing

Problem-Solving Environment (PSE) enables the Labs to have a high-performance, secure, integrated infrastructure





ASCI PSE Simulation Development Environment: *Scope and Requirements*

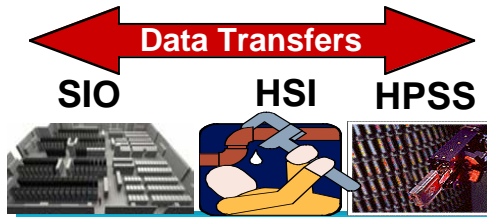


Scope of this project:

- Critical *user level* development and run-time software
- Methods and analysis to enhance performance of ASCI applications

Requirements:

- A common, full functioning *development environment*:
 - compilers, parallel debugging and performance tools, ...
- Scalable, robust, reliable, *run-time systems* (e.g. MPI and thread packages)
- Portable *parallel programming models*
- *Performance tuning*, modeling, analysis and benchmarking services
- Scalable *linear and non-linear solvers* deployed in the codes
- Portable high performance *application frameworks* to facilitate code reuse



ASCI PSE Data Transfer and Storage: *Scope and Requirements*



- **Scope of this project:**
- “end-to-end” high-performance I/O and data movement capabilities for ASCI Stockpile Stewardship 3D physics simulations
- Integrated I/O subsystems, hierarchical storage management, visualization needs, networks and capacity computers for pre- and post-processing
- **Requirements:**
- ASCI calculations in 2004-2005 will need platform disk I/O rates at 100-150 GB/s and archival tape I/O rates at 10-15 GB/s
- Reliable, scalable, *parallel I/O libraries and file systems*
- Reliable, *high speed interconnects* to peripherals and servers
- High-capacity, high-performance, reliable *archival storage systems*
- Must scale with ASCI platform capabilities and application data needs



ASCI PSE Computer System Infrastructure: *Scope and Requirements*



Scope of this project: the critical *system* software Infrastructure for secure, effective use of ASCI platforms for Stockpile Stewardship physics simulations

Requirements:

- Common *security infrastructure* and tools for NWC
- Node *operating systems* that function effectively for ASCI applications in a large cluster environment
- Effective *resource management* systems for ASCI computers
- Scalable easy-to-use *system administration tools*
- Effective *system level diagnostics* to ensure platform reliability



ASCI Software Requirements



We need software tools and technologies that enable our applications codes to be more:

- Scalable
- Portable
- Parallelized

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